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STUDY OF THE CORROSION RESISTANCE OF VARIOUS METALS TO THE ACTION OF DICHLOROETHANE

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Wright-Patterson Air Force Base, Ohio

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EDITED TRANSLATION

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13. ABSTRACT

Corrosion resistances were detd. for Pb, St. 5, Cu, Al, 1Kh18N9T stainless steel, and cast iron SCH15 exposed to boiling ClCH2CH2Cl (I) heteroazoeotropes (of 9 hydrolyzate systems, where I is used as a solvent in processes on hydrolyzing cotton seed husks) and to I vapors; no HCl formation was obsd. in smaller than 3 hr exposures to boiling dil. I solns. Al and Cu were the most corrosion resistant and SCH15 the least corrosion resistant to I. [AT1201888]

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Metal Corrosion Resistance Lead Carbon Steel Copper Aluminum Stainless Steel Cast Iron Chloroethane/(U)SCH15 Cast Iron (U)1Kh18N9T Stainless Steel (U)ST5 Carbon Steel						

U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
З з	*З з*	Z, z	Ч ч	*Ч ч*	Ch, ch
И и	*И и*	I, i	Ш ш	*Ш ш*	Sh, sh
Й й	*Й й*	Y, y	Щ щ	*Щ щ*	Shch, shch
К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

* ye initially, after vowels, and after ъ, ь; e elsewhere. When written as ё in Russian, transliterate as yё or ё. The use of diacritical marks is preferred, but such marks may be omitted when expediency dictates.

STUDY OF THE CORROSION RESISTANCE OF VARIOUS METALS TO THE ACTION OF DICHLOROETHANE

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The question of the resistance of various metals to the action of dichloroethane is of interest from the point of view of the selection of material for equipment in the hydrolysis of vegetal resources by concentrated sulfuric acid in this solvent.

As is known, hydrolysis proceeds in two stages. First, the polysaccharides of the vegetal resources are converted to low-molecular oligosaccharides in an organic solvent at a comparatively low temperature (50-80°) with the use of concentrated sulfuric acid. Then the obtained hydrolysate mass is diluted with water to a 5-7.5% concentration of sulfuric acid in it and the oligosaccharides are converted to monosaccharides by heating with the simultaneous distillation of the solvent from the hydrolysate.

Under the indicated temperature conditions the molecules of dichloroethane and water enter into a hydrolysis reaction with the formation of a volatile hydrochloric acid which has a strong corroding action on the material of the equipment

$$\begin{matrix} H_2C{-}Cl \\ | \\ H_2C{-}Cl \end{matrix} + 2H_2O \longrightarrow \begin{matrix} H_2C{-}OH \\ | \\ H_2C{-}OH \end{matrix} + 2HCl.$$

In literature there are quantitative characteristics of the corrosion of steel in the presence of moist dichloroethane and a mixture of vapors of dichloroethane and water [1, 2]. Under these conditions the corrosion of steel is insignificant - with a duration of test of several hours it comprises 0.25-0.50 g/m^2 (1 mm of surface thickness is destroyed in 3-4 years).

Ellis [3] points out that dichloroethane is the most stable of the generally accepted chlorinated hydrocarbons and, in the presence of water at boiling temperature, does not cause corrosion of metal equipment. However, in the literature presented there are no direct indications of the stability of dichloroethane dissolved in water at boiling temperature which is favorable for hydrolysis. In this connection, we have conducted the corresponding tests, the results of which are presented in Table 1.

We determined the degree of hydrolysis from the acidity of the solution by means of its titration with 0.1 normal solution of KOH in the presence of phenolphthalein. In this regard, used in the tests was circulating dichloroethane with which the repeated hydrolysis of cotton pods was conducted with concentrated sulfuric acid. In the process of repeated distillation, the dichloroethane was cleansed of foreign substances and seemed to be stabilized.

From Table 1 it can be seen that the acidity of the solution increases only after three hours of boiling.

Table 1. Increase in the acidity of solution of dichloroethane depending on the duration of boiling.

Duration of boiling. hours	Degree of hydrolysis. %
1	0,00
2	0,05
3	0,44
4	0,86
5,5	1,80
9,5	2,05
12,0	2,20
16,0	2,50
—	—
—	—

The technological scheme provides for the stay of the dichloroethane in the hydrolysate at boiling temperature for no more than 0.5 hours. Moreover, it is necessary to consider that the quantity of dichloroethane in the solution will be reduced with its removal from 13 kg to 2 g in one cubic meter of hydrolysate during the time of 0.5 hours. Consequently, the amount of hydrochloric acid being formed will be reduced in the same sequence. Practically no decomposition of the dichloroethane occurs during three hours of boiling. Hence it follows that there will be almost no products of the hydrolysis of dichloroethane - hydrochloric acid and glycol - in the hydrolysate.

The tests of the resistance of metals to dichloroethane in a solution of a heteroazeotrope of the dichloroethane-hydrolysate system which were conducted at boiling temperature for 24 hours showed the following results (Table 2).

Table 2. Resistance of metals in dichloroethane.

Test conditions	Weight loss from 1 cubic meter in a day, grams					
	lead	steel 5	copper	aluminum	stainless steel 1Kh18N9T	cast iron SCh-15
In liquid	0,6739	1,1718	0,6513	0,0989	0,8865	2,4694
In an atmosphere of dichloroethane vapors	0,2115	2,0104	0,1861	0,0781	1,4907	5,2360

As can be seen from the table, the most stable metals to the action of dichloroethane are copper and aluminum while cast iron SCh-15 is less resistant. Loss of weight of the metals was insignificant.

* * *

Tests on the study of corrosion resistance of metals to the action of dichloroethane showed that the loss in the weight of metals in an atmosphere of this solvent is insignificant and —

the dichloroethane molecule is comparatively stable; the acidity of a solution of dichloroethane in boiling increases noticeably only by the third hour. Therefore, there is no need to fear heavy corrosion of equipment in using dichloroethane as a solvent in the process of the hydrolysis of vegetal resources by concentrated sulfuric acid.

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